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THE BLACK-HEADED BUDWORM SURVEY

ON THE TONGASS NATIONAL FOREST, ALASKA

Season of 1955

by

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SUMMARY

During the summer of 1955, black-headed budworm (Acleris variana Fernald) infestations on the Tongass National Forest extended throughout approximately 2,900,000 gross land acres. Of this total, 2.7 million acres comprised the remaining area of the old outbreak and .2 million acres contained scattered pockets of light black-headed budworm defoliation of current or more recent origin.

Top killing of western hemlock and Sitka spruce was confined to an area of approximately 620,000 gross acres in the vicinity of Icy Strait. The center of the outbreak was in Excursion Inlet with moderate defoliation and much lighter top killing extending west to the Glacier Bay National Monument and south along the northwest portion of Chichagof Island. The budworm was also active north of Skagway in the White Pass area but damage was light. Defoliation throughout the remaining 2.1 million acres of the old outbreak body was confined to trees near timberline where very little damage was inflicted.

Scattered pockets of light black-headed budworm defoliation were found on the islands west of Prince of Wales Island and in the Ketchikan area. These epidemic centers are of recent origin and extend throughout an area of approximately 210,000 acres. To date little or no permanent damage has been inflicted on the hemlock.

Rangers and other field personnel were again requested to submit hemlock twig samples so that budworm eggs could be counted and the trend of the outbreak determined. From these twig samples all indications are that the main budworm outbreak in Southeast Alaska has come to an end. No epidemic concentrations of eggs have been uncovered.

The trend of budworm populations from the scattered epidemic areas at the south end of the Tongass is not known. Some budworm populations had been greatly reduced by parasites but unfortunately egg counts in these areas are not available.

The most noteworthy observation to be made during the survey of 1955 was that the black-headed budworm has caused complete tree kill, which in some locations has seriously reduced the volume of green hemlock in the stands so affected. Furthermore, it appears that some hemlock which were heavily defoliated several years ago are dying. This latter observation needs study in order to appraise the situation.

The larval parasite Elachertus sp. was very common in a great number of dead needle clusters collected from widely distributed locations. Action of this parasite put an end to budworm defoliation in the Juneau area.

The hemlock sawfly (Neodiprion tsugae Middleton) has again reached epidemic proportions scattered over 1.2 million acres between Ketchikan and Wrangell. At present individual trees are suffering heavy defoliation within scattered pockets of general sawfly activity.

INTRODUCTION

The black-headed budworm outbreak has been systematically followed by annual fall surveys since 1952. As in previous years forest rangers and other field personnel were relied upon to collect hemlock twigs from which the budworm egg counts were made.

An unusually wet cold summer retarded budworm development throughout the entire life cycle and this retardation caused such a delay in the egg sampling that some areas had to be passed up as rough weather set in. Additional areas are yet to be sampled but winter storms, already prevalent, will seriously limit the amount of such sampling.

THE OUTBREAK

History

The following account is taken from the 1954 report.

> The outbreak of the black-headed budworm began about 1947, probably in a number of locations throughout the southern half of the Tongass National Forest. The first evidence of budworm feeding was noticed at the mouth of Anan Creek in 1948. By 1950, the infestation was widespread and much in evidence in the Twelve Mile Arm on Prince of Wales Island, and northeast to the Bradfield Canal - a distance of approximately 60 miles. During the summer of 1951, heavy budworm feeding was evident over most of Prince of Wales Island and from Ketchikan to Petersburg. The outbreak extended across some 140 miles. In 1952 the budworm had become epidemic from the Portland Canal to the Admiralty Lakes region on Admiralty Island - an area encompassing about 11,600,000 acres, and extending across 240 miles.
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> The budworm outbreak reached its greatest extent in 1953. During that year the budworm was epidemic over the entire Tongass National Forest, an area of 16,073,000 acres. The outbreak extended from the Portland Canal to Yakutat, a distance of about 500 miles. It became evident in 1953 that while the range of the budworm outbreak continued to enlarge, the severity of defoliation was decreasing. Hemlock stands throughout 8,000,000 acres in the areas of previous heavy feeding south of Frederick Sound were suffering only light defoliation. Defoliation was heavy north of Frederick Sound to Juneau and west to the eastern portions of Chichagof and Baranof Islands. North of Juneau and at Yakutat defoliation was light.

During the summer of 1954 the budworm epidemic extended from the southern tip of Baranof Island to Skagway a distance of 225 miles. The total gross area infested was approximately 6,740,000 acres of which some 400,000 acres were within the Glacier Bay National Monument. Heaviest defoliation of hemlock occurred in Lynn Canal and throughout the northern half of Chichagof Island. Light but readily visible defoliation extended throughout the remainder of the island, over Baranof and Admiralty Islands, and in the Glacier Bay area.

Present Status

The heart of the black-headed budworm outbreak during 1955 was in Excursion Inlet. In this relatively small area on the north side of Icy Strait budworm defoliation was very heavy and top killing is most likely to occur. Defoliation extended from the shore to timberline and was heaviest at the lower elevations up to approximately 1000 feet. The hemlock sawfly was also abundant in this area. On September 21 when examinations were made for budworm eggs, the budworm was mostly in the pupal stage and no eggs were found. Night temperatures were below freezing at that time.

Areas of lighter budworm defoliation extended west of Excursion Inlet to the west side of Glacier Bay and south along the northwest portion of Chichagof Island. Many of the latter areas were heavily defoliated in 1954 and top kill of hemlock is common.

Very noticeable budworm defoliation occurred on mountain and western hemlock in the Endicott River area and on spruce near the headwaters of the Skagway River. Both areas of defoliation were near timberline where moderate appearing defoliation has been observed to do little damage.

The total area of generally moderate to heavy defoliation within which some top killing of hemlock can be expected, covers approximately 620,000 gross acres. The remaining 2.1 million acres within the boundaries of the old outbreak contained black-headed budworm populations capable of only light defoliation, and this in the stands near timberline. Since heavier defoliation at timberline has been observed to cause little damage and no top killing to either western or mountain hemlock, the areas presently defoliated can be expected to make quick recovery.

Scattered light epidemic pockets of the black-headed budworm were found on Dall, Suemez, Baker and Heceta Islands west of Prince of Wales Island, and in the vicinity of Ketchikan at Ward Cove, Mud Bay and other nearby locations. The epidemic pockets on the islands were on the ocean side and were more or less widely separated from each other. No pockets are extensive in size and no serious defoliation of hemlock was observed.

Moths were evident at Mud Bay and Ward Cove, but evidence of parasitism, especially the larval parasite Elachertus sp. was common. Pupal parasites were also quite evident.

These small epidemic pockets of the budworm are not related to the main outbreak and are believed to be of recent origin. They extend throughout an area of approximately 210,000 acres, but the actual area of infestation is much less.

Prior to this year it was felt by the writer that the black-headed budworm was not causing complete tree kill but only top kill, which in some stands was destroying a fair portion of tree length, especially in the largest trees. Observations made this year at Thayer Lake on Admiralty Island, and Orchard Lake on Revillagigedo Island, show that the initial assumption was not correct and that the budworm is capable of killing entire trees. Just what percent of the trees in heavily defoliated stands has been killed is yet to be determined, but initial estimates are placed at ten percent. In terms of volume the percentage of budworm kill will be higher. Furthermore, conditions have been observed which strongly suggest that hemlock, which was heavily defoliated, may continue to lose growth and eventually die. This condition was also noted at Thayer Lake and Orchard Lake and has been mentioned by other field personnel.

It must be pointed out that this hemlock kill and volume loss constitutes only a very small portion of the total timber supply, but in certain restricted areas could influence the cutting schedule.

Trend

The cold wet summer and fall retarded black-headed budworm development to such an extent that hemlock twig sampling had to be delayed until after some field crews had completed their field work. Consequently, we are still gathering twig samples and hope to find no unexpectedly large egg populations. As in previous years, trend of the outbreak is determined from budworm egg concentrations found on fixed hemlock twig samples. Defoliation can be expected to be serious when egg counts of .11 eggs per twig-inch of needles are reached. Results of the 1955 twig sampling are presented in Table I.

Examination of Table I reveals that no budworm egg concentrations were found which can be classed as epidemic. If these samples are truly representative of actual field conditions then it is likely that the main budworm outbreak in Southeast Alaska has come to an end. It is likely that a further break up in the area of noticeable defoliation can be expected and that some isolated pockets of defoliation may be detected within the outbreak area which will be classed as epidemic but certainly not of outbreak proportions.

Reference to Table I also shows that the larval parasite Elachertus sp, was common at a number of collecting locations. Foliage samples from which Elachertus was common showed only limited budworm damage. This parasite was so common in the Juneau area that it completely destroyed budworm populations which were under study.

Table I.--Black-headed budworm egg count data collected from hemlock twig samples. Tongass National Forest, Fall of 1955.

	Location	No. of 10" twigs in sample	Twig inches of needles *	Eggs	Eggs per twig inches of needles	Date sample collected	Remarks
1.	Juneau	30	940	1	.00	October 10	Trace of sawfly
2.	Mile 14	30	940	1	.00	October 10	
3.	Mile 23	30	940	0	.00	October 10	Elachertus sp. very abundant
4.	Mile 27	30	940	0	.00	October 10	
5.	Herbert River	30	940	0	.00	October 10	
6.	Hawk Inlet	30	940	0	.00	October 10	Elachertus sp. common
7.	Favorite Bay	30	940	1	.00	October 11	Elachertus sp. common
8.	Whitewater Bay	30	940	0	.00	October 12	
9.	Eliza Harbor	31	940	0	.00	October 12	Elachertus sp. common
10.	Petersburg	26	815	1	.00	October 21	
11.	Elfin Cove	29	833	11	.01	October 16	
12.	Tenakee Hot Sp.	30	940	4	.00	October 14	
13.	Chichagof Mine	30	940	0	.00	October 19	
14.	Salt Lake Bay	30	940	1	.00	November 8	
15.	Sea Gull Creek	30	940	3	.00	November 7	
16.	Spasski Creek	30	940	0	.00	November 9	
17.	Little Naukatii	30	940	0	.00	November	
18.	Sarkar Cove	30	940	0	.00	November	
19.	Sarkeen	30	940	0	.00	November	
20.	Shipley Bay	30	940	0	.00	November	
21.	French Cove	30	940	0	.00	November	
22.	Cape Pole	30	940	0	.00	November	

* Unless otherwise noted 940 inches is used as the standard sample size of 30 hemlock twigs. Unless the egg count exceeded 10, twig inches of needles were not measured.

The trend of budworm populations within the scattered epidemic areas at the southern end of the Tongass is not known. Ground examinations and egg counts were made on September 23 in a number of areas in the vicinity of Ketchikan. Some moths were seen but evidence of larval and pupal parasitism was common and the budworm population was low. Unfortunately, budworm development was so retarded that even at the late date of September 23 oviposition was far from completed and trend samples were inadequate.

METHOD OF SURVEY

The black-headed budworm survey was conducted in the same manner as in previous years. The aerial flight lines were flown contouring the terrain and placed in such manner as to avoid, whenever possible, muskeg areas and timber types containing moderate volumes of cedar. Flight coverage was heaviest throughout the northern end of the budworm outbreak area and over the sawfly epidemic areas. No aerial survey was conducted between Sumner Strait and Frederick Sound due to the persistence of poor weather.

The aerial survey of the Tongass was accomplished in 40.5 flying hours which cost just under $1200. Since the land mass of the Tongass Forest is slightly larger than 16,000,000 acres, it can be seen that one flying hour was devoted to every 395,000 land acres. If the acreage of glaciers and barren mountain tops, which were not flown, be substituted by acreage of water, which had to be crossed, the aerial coverage of acres per hour would perhaps remain about the same.

As in previous years, field personnel were requested to collect hemlock twig samples for budworm egg counts. The sample consisted of thirty 10-inch twigs, five twigs from each of six trees, cut at each area. Exposed twigs were cut, preferably from the tops of young open grown trees, bundled and stored in moist wrapping until they could be air-freighted to Juneau. The egg counts thus obtained are presented in Table I.

FACTORS CAUSING OUTBREAK DECLINE

Egg parasitism by Trichogramma minutum Riley showed no change in the Juneau area from that found in previous years. Egg parasitism was found to range from .8 percent to 5.4 percent.

A moderate budworm population which had been designated for parasite study was completely destroyed by parasites by the time the budworm larvae had become half grown. The chalcid Elachertus sp. was found in every damaged needle cluster. This parasite was also common on the foliage examined from many of the twig collecting locations.

In 1954 Microgaster peroneae Walley, Actia diffidens Cu. and Itoplectis quadricingulatus Cush. were by far the most abundant parasites of the budworm. This year Elachertus sp. must certainly be added to that list of parasites primarily responsible for the continuing budworm decline.

Very little evidence of disease was seen in the 1955 budworm larvae.

HEMLOCK SAWFLY

The hemlock sawfly is again epidemic, for the most part in areas unrelated to those in which the budworm is active. It is estimated that the sawfly is presently epidemic throughout 1.2 million acres in the southern portion of the Tongass National Forest. The actual area of defoliation is only a fraction of this acreage as the epidemic is in widely scattered pockets, and within pockets not all hemlock trees are being defoliated. Defoliation was first noticed by Ranger Burt Clark in the George Inlet area. A subsequent ground examination revealed scattered sawfly feeding, which on some trees had removed a very high percentage of the hemlock needles. Sawfly coccons were collected and placed in rearing for parasite emergence. To date only 5 parasites have emerged from a collection of 100 cocoons.

The sawfly areas mapped in the vicinity of Craig were mapped from the air as possible sawfly. Foliage conditions similar to very light sawfly feeding were scattered high on the slopes and such areas were visible only at close range.

The sawfly is again active in Excursion Inlet but is much less severe than the southern epidemic. The sawfly is not heavy enough to make combined budworm-sawfly feeding fatal to the hemlock.

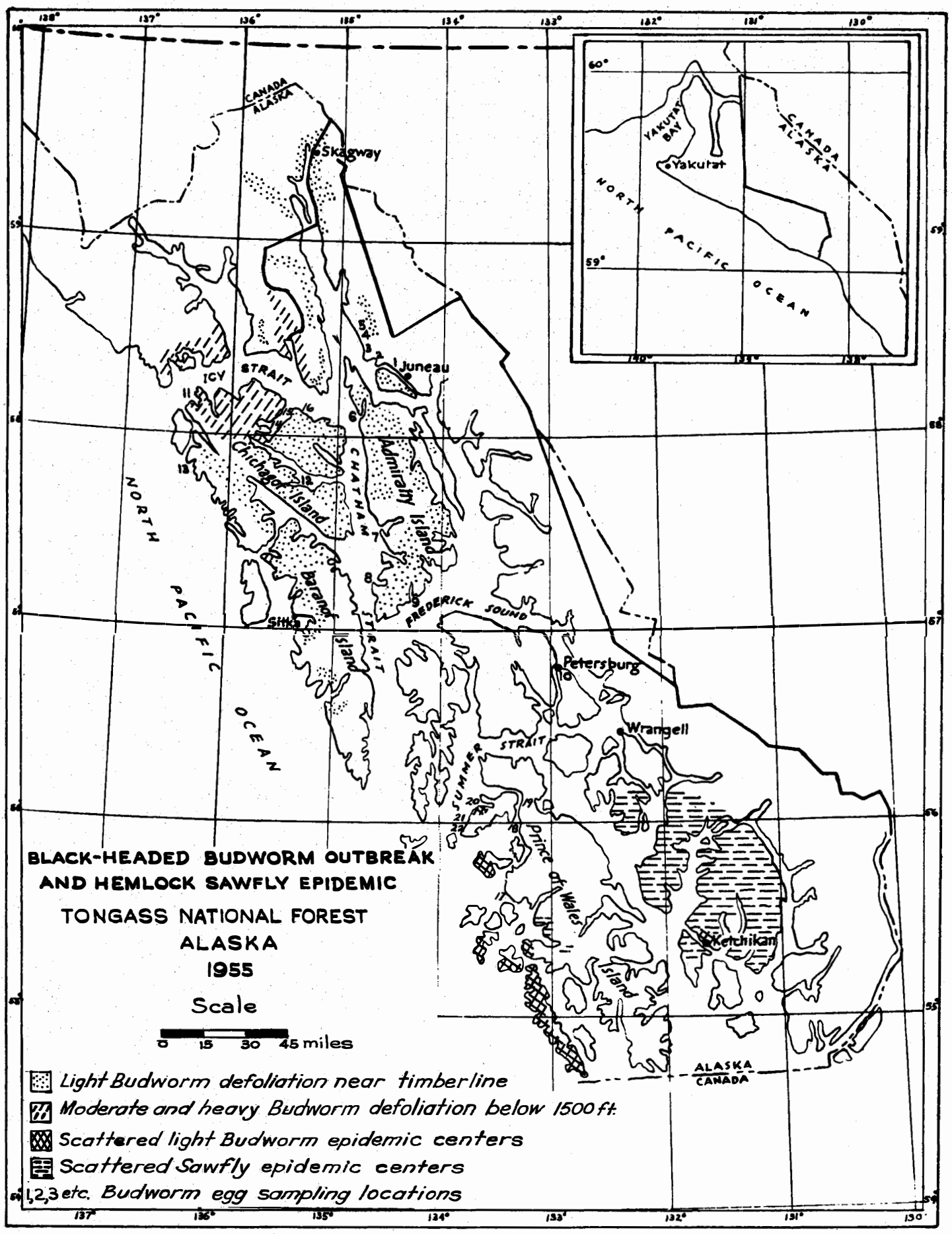
RECOMMENDATIONS

1. An aerial survey no less extensive than the 1955 survey should be conducted in the fall of 1956. The survey should concentrate on the northern budworm areas, the southern budworm epidemic pockets and the outer limits of the hemlock sawfly should be redetermined.

2. Tree mortality plots should be established to determine the long term effect of budworm defoliation. Plots should be established at Thayer Lake, Orchard Lake, and perhaps Frederick Point near Petersburg. These are areas of heavy top kill and some complete tree kill. Mortality cruises should also be run in these areas to determine the percent of trees killed, the volume so affected, and the rate of stand deterioration.

3. As a long term endeavor, economical methods of determining budworm populations in terms of expected destruction must be developed. Should the tree mortality and stand deterioration studies substantiate it, perhaps the correct approach to the black-headed budworm problem in Alaska is to spray those stands of adequate volume which harbour budworm populations capable of causing extensive top kill and complete tree kill. While the outbreak of recent years has swept across millions of acres, the areas of serious top and tree kill are relatively small and expenditures to treat such areas by aerial spray might not be excessive.

4. A sawfly egg survey should be conducted in the spring of 1956 to determine the extent and severity of sawfly populations.


BLACK-HEADED BUDWORM OUTBREAK
AND HEMLOCK SAWFLY EPIDEMIC
TONGASS NATIONAL FOREST
ALASKA
1955
Scale
0 15 30 45 miles
Light Budworm defoliation near timberline
Moderate and heavy Budworm defoliation below 1500 ft.
Scattered light Budworm epidemic centers
Scattered Sawfly epidemic centers
1,2,3 etc. Budworm egg sampling locations
CANADA
ALASKA
Skagway
Juneau
ICY STRAIT
Chichagof Island
CHATHAM
Admiralty Island
NORTH PACIFIC OCEAN
Baranof Island
Sitka
FREDERICK SOUND
Petersburg
Wrangell
SUMMER STRAIT
Prince of Wales Island
Ketchikan
ALASKA
CANADA
YAKUTAT BAY
Yakutat
NORTH PACIFIC OCEAN